SYNTHETIC RESIN THIN-WALLED BOTTLE CONTAINER

BACKGROUND ART

Technical Field

[0001] The present invention relates to a synthetic resin thin-walled bottle container comprising a mouth portion for filling or discharging contents, a body portion extending from the mouth portion, and a heel portion provided at a bottom part of the body portion, for placing the body portion thereon in a self-supporting manner.

Related Art

[0002] Synthetic resin thin-walled bottle containers are thinner than ordinary bottle containers and are thus capable of achieving light-weighted containers and reduction in the volume of wastes. As such, this sort of synthetic resin containers are used as refill containers for detergents for kitchen use, bathroom use and the like.

[0003] Meanwhile, the thin-walled bottle containers are sometimes used as they stand, and are thus provided with an annular heel portion near a bottom surface of the container's body portion so as to cause the container itself to self-support on a supporting surface such as shelf or table. Further, the heel portion comprises a sidewall having a curved surface bulged toward the outside of the container, a flat and annular bottom face region continuous to the sidewall, and a bottom-up region continuous to the bottom face region and inwardly recessed toward the vicinity of a bottle's center axis.

[0004] This sort of thin-walled bottle containers are stretch blow molded from a thermoplastic synthetic resin such as polypropylene (PP), so that the molded article (bottle container) has a non-uniform wall thickness, thereby failing to completely eliminate occurrence of so-called "thickness deviation". Therefore, when it is contemplated to further reduce the resin amount in a conventional thin-walled bottle container in view of environmental problems, the bottle container in a contents-filled state may cause inclination and/or buckling at a thin-walled region of the heel portion where the thickness-deviation has

occurred, under a load applied in a center axis direction of the container.

DISCLOSURE OF THE INVENTION

[0005] It is therefore an object to be achieved by the present invention, to provide a synthetic resin thin-walled bottle container which, when filled with contents, can be stably self-supported without causing inclination or buckling under a load applied in the center axis direction of the container, while allowing reduction of the resin amount.

[0006] To achieve such an object, the present invention provides a synthetic resin thin-walled bottle container comprising a mouth portion for filling or discharging contents, a body portion extending from the mouth portion, and a heel portion provided at a bottom part of the body portion for placing, thereon, the body portion in a self-supporting manner, wherein the heel portion comprises a sidewall having a curved surface recessed toward the inside of the container.

[0007] According to the present invention, the heel portion of the synthetic resin thin-walled bottle container comprises the sidewall formed of the curved surface recessed toward the inside of the container in a so-called "reverse R" manner. The sidewall constituted in such reverse R manner produces an increased restoring force even when the container is applied with a load in the center axis direction, for example. It is therefore possible to provide a synthetic resin thin-walled bottle container which, even when filled with contents, can be more stably self-supported without causing inclination or buckling under a load applied in the center axis direction, while allowing reduction of the resin amount.

[0008] It is preferred that the heel portion further comprises a bottom face region formed of a curved surface continuous to the sidewall and bulged toward the outside of the bottle container, a bottom-up region inwardly recessed toward the vicinity of the bottle center axis, and a rising region for smoothly connecting the bottom face region and the bottom-up region to each other. In this instance, the bottom face region and the rising region are bulged toward the

underside of the bottle container when it is filled with the contents due to the thin-walled nature of the bottle container. However, when such a container is placed on a supporting surface, these bulged portions are brought to form a flat surface to be closely contacted with the supporting surface. It is thus possible to further improve the stability of the bottle container when the same is self-supported.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIGS. 1(a) and 1(b) are a side view and a bottom view, respectively, showing a bottle container according to a first embodiment of the present invention.

[0010] FIG. 2 is an enlarged side view of a bottom part of the container of the first embodiment.

[0011] FIG. 3 is an enlarged view showing the relevant parts in a second embodiment of the present invention.

[0012] FIG. 4 is an enlarged view showing the relevant parts in a third embodiment of the present invention.

[0013] FIG. 5 is a conceptional view showing the testing method for testing a buckling strength of the thin-walled bottle containers according to the first through third embodiments, respectively, and a thin-walled bottle container of a comparative example.

[0014] FIG. 6 is a graph illustrating the test results in respect of the buckling strengths of the thin-walled bottle containers according to the first through third embodiments, respectively, and the thin-walled bottle container of the comparative example.

[0015] FIG. 7 is an enlarged showing the relevant parts in the thin-walled bottle container according to a comparative example.

BEST MODE FOR CARRYING OUT THE INVENTION

[0016] Some preferred embodiments of the present invention will be more fully described below with reference to the accompanying drawings.

[0017] FIGS. 1(a) and 1(b) are a side view and a bottom view, respectively, showing a bottle container 10 according to a first embodiment of the present invention.

[0018] The bottle container 10 is a thin-walled one, having a volume of 560cc and obtained by stretch blow molding a PP (polypropylene) resin in an amount of 6g, and comprises, as shown in FIG. 1(a), a mouth portion 11 for filling or discharging contents, a body portion 12 extending from the mouth portion 11 along a center axis A of the container 10, and a heel portion H_{10} provided at a bottom part 13 of the body portion 12 so as to cause the container 10 to be self-supported on a supporting surface.

[0019] More specifically, for example, the mouth portion 11 has a structure, onto and from which a screw cap (not shown) can be fitted and detached. In this instance, the cap to be fitted onto the mouth portion 11 is not limited to the screw cap, and there may be alternatively used existing ones such as a hinge-type cap or irremovable virgin. Further, the body portion 12 has a sidewall provided with a reinforcing portion 12a in a diamond-cut pattern at a shoulder portion of the body portion adjacent to the mouth portion 11, and a gripping recess 12b for enhancing the gripping force to be applied by users.

[0020] FIG. 2 is an enlarged view showing the bottom part 13 of the bottle container 10 in enlarged scale. As shown in FIG. 2, the heel portion H_{10} comprises, in an annular manner around the bottle axis A, a sidewall 14 formed of a curved surface recessed toward the inside of the bottle container 10, a bottom face region 15 formed of a curved surface continuous to the sidewall 14 and bulged toward the outside of the bottle container 10, a bottom-up region 16 represented by a broken line and inwardly recessed toward the vicinity of the center axis A, and a rising region 17 for continuously connecting the bottom face region 15 and the bottom-up region 16 to each other.

[0021] By way of example, the sidewall 14 at the heel portion H_{10} is constituted of a curved surface having a radius of curvature R_{11} and connected to the sidewall of the body portion 12 through a curved surface having a radius of curvature R_{10}. The bottom face region 15 is constituted of a curved surface having a radius of curvature R_{12} and

continuous to the sidewall 14. Further, the bottom-up region 16 is constituted of a curved surface having a radius of curvature R_{13}, and provided with an annular groove 16a around the center axis A, the annular groove having been formed by holding an end of a preform so as to avoid an axis deviation thereof upon stretching the preform. The bottom face region 15 and the bottom-up region 16 are connected to each other through the rising region 17 having a larger radius of curvature, i.e., constituted of a curved surface having a radius of curvature R_{14} and smoothly continued along a tangential line of the bottom face region 15.

[0022] Since such a bottle container is molded by stretch blow molding a thermoplastic resin such as polypropylene (PP), as described above, it is practically impossible to completely eliminate thickness deviation at those parts constituting the angled faces such as the heel portion. Therefore, when the resin amount of the thin-walled bottle container is reduced, and such container as being internally filled with contents is to be self-supported, the container tend to give rise to inclination and/or buckling at the thin-walled region of the heel portion where a thickness-deviation has occurred.

[0023] Since, however, the heel portion H_{10} of the thin-walled bottle container 10 according to the present embodiment comprises the sidewall 14 formed of the curved surface that is recessed toward the inside of the container 10 (in a so-called "reverse R" manner), the sidewall 14 constituted in such reverse R manner has an increased restoring force even when the side surface of the container 10 is applied with a lateral load, for example. It is thus possible, according to the present embodiment, to provide a synthetic resin thin-walled bottle container, which can be more stably self-supported even when filled with contents, without causing inclination or buckling, while allowing reduction of the resin amount.

[0024] According to the present embodiment, in particular, the heel portion H_{10} comprises the bottom face region 15 formed of the curved surface continuous to the sidewall 14 and bulged toward the outside of

the bottle container 10, the bottom-up region 16 inwardly recessed toward the vicinity of the bottle center axis A, and the rising region 17 for continuously connecting the bottom face region 15 and bottom-up region 16 to each other. The bottom face region 15 and rising region 17 are bulged toward the underside of the container 10 when it is filled with the contents, due to the thin-walled nature of the container 10. However, when the container is placed on the supporting surface such as shelf or table, these bulged portions are brought to form a flat surface to be closely contacted with the supporting surface, thereby further improving the stability of the container 10 when the same is self-supported.

[0025] FIG. 3 and FIG. 4 are enlarged views showing the relevant parts in a second embodiment and a third embodiment of the present invention, respectively.

[0026] The thin-walled bottle container 20 according to the second embodiment includes, as shown in FIG. 3, a heel portion H_{20} connected to a body portion 22 and comprises, in an annular manner around the center axis A, a sidewall 24 formed of a curved surface having a radius of curvature R_{21} so as to be recessed toward the inside of the container 20, a bottom face region 25 formed of a curved surface having a radius of curvature R_{22} so as to be continuous to the sidewall 24 and bulged toward the outside of the container 20, a bottom-up region 26 represented by a broken line and formed to have a radius of curvature R_{23} so as to be inwardly recessed toward the vicinity of the center axis A of the container, and a substantially planar rising region 27 having a radius of curvature R_{24} for continuously connecting the bottom face region 25 and bottom-up region 26 to each other. This embodiment is basically the same as the first embodiment, but is different therefrom in that the sidewall 24 is formed with an annular groove 24a around the bottle axis A.

[0027] Similarly, the thin-walled bottle container 30 according to the third embodiment shown in FIG. 4 includes a heel portion H_{30} connected to a body portion 32 and comprises, in an annular manner

around the center axis A, a sidewall 34 formed of a curved surface constituted to have a radius of curvature R_{31} so as to be recessed toward the inside of the container 30, a bottom face region 35 formed of a curved surface having a radius of curvature R_{32} so as to be continuous to this sidewall 34 and bulged toward the outside of the container 30, a bottom-up region 36 represented by a broken line and constituted to have a radius of curvature R_{33} so as to be inwardly recessed toward the vicinity of the center axis A, and a substantially planar rising region 37 having a radius of curvature R_{34} for continuously connecting the bottom face region 35 and bottom-up region 36 to each other. This embodiment, too, is basically the same as the first embodiment, but is different therefrom in that the radius of curvature R_{31} defining the sidewall 34 provided at the heel portion H_{30} is set to be smaller than the radius of curvature R_{11} of the sidewall 14 in the first embodiment, thereby providing a curved surface exhibiting a stronger recession.

[0028] FIG. 5 and FIG. 6 are a conceptional view of a buckling strength testing method and a graph illustrating test results thereof, respectively, in respect of the above described thin-walled bottle containers 10 through 30 according to the first through third embodiments, respectively, and a conventional thin-walled bottle container 40 (comparative example).

[0029] As shown in FIG. 7, the thin-walled bottle container 40 according to the comparative example includes an annular heel portion H_{40} arranged near a bottom surface 43 of a body portion 42 and comprises a sidewall 44 having a curved surface (of radius of curvature R_{40}) bulged toward the outside of the bottle container 40, a flat and annular bottom face region 45 continuous to the sidewall 44, and a bottom-up region 46 continuous to the bottom face region 45 and inwardly recessed toward the vicinity of the bottle center axis A.

[0030] With reference to FIG. 5, in order to perform the buckling strength test, there have been produced cup-like test pieces S_{10}, S_{20}, S_{30}, S_{40} by preparing the bottle containers 10 through 40, each having

the heel portion H_{10}, H_{20}, H_{30}, H_{40} with a thickness deviation of 10%, and horizontally cutting the body portions of the containers. Then, a pressure plate is placed onto the cut edge of each of the test pieces S_{10}, S_{20}, S_{30}, S_{40} so as to apply a compressive load F in the center axis direction until buckling occurs, while measuring a lateral deformation extent at the bottom part of each test piece upon buckling. Needless to say, the containers 10 through 40 for preparing the test pieces S_{10}, S_{20}, S_{30}, S_{40} have essentially the same wall thickness and dimensions, except for the configurations of the heel portions H_{10}, H_{20}, H_{30}, H_{40}, respectively.

[0031] The test results are illustrated in FIG. 6 as a graph wherein the abscissa represents the lateral deformation extent (mm) at the bottom part of the relevant test piece, and the ordinate represents the buckling strength (kg) thereof under the compressive load F, with respect to the following test pieces:

- Test piece S_{10}: container 10 of the first embodiment,
- Test piece S_{20}: container 20 of the second embodiment,
- Test piece S_{30}: container 30 of the third embodiment, and
- Test piece S_{40}: container 40 of the comparative example.

[0032] As can be appreciated from FIG. 6, the test pieces S_{10}, S_{20}, S_{30} prepared from the thin-walled bottle containers 10 through 30 according to the present invention exhibit lateral displacement extents which are reduced down to as less as about 20% of that exhibited by the test piece S_{40} prepared from the conventional thin-walled bottle container 40. Thus, the thin-walled bottle containers 10 through 30 according to the present invention, when filled with the contents, can be effectively restored to the erected positions, respectively, without causing inclination or buckling under the load in the center axis direction.

[0033] Although the present invention has been described above with reference to the illustrated preferred embodiments, it is apparent that various modifications may be made without departing from the scope of the appended claims. For example, the amount of the resin

constituting the thin-walled bottle container is not limited to 6g for the container volume of 560ml, and may be variously modified to 9g through 11g equivalently to typical thin-walled bottle containers.

It is also possible to appropriately modify the volume of the bottle container to 350ml, 500ml, 1,000ml, 2,000 ml or the like, as required.

Furthermore, the shape of the bottle body portion may be a typical one without reinforcing portion 12a and gripping recess 12b such as those provided in the first embodiment.